REMARKS

Claims 1 and 3-14 are pending and stand rejected. Applicants have amended claims 1 and 13-14 and added new claims 15-20. No new matter is added by the foregoing amendments. The amendments are supported by the specification as originally filed. In view of the following discussion, the applicant submits that all pending claims are in condition for allowance.

On page 2 of the Office Action the Examiner rejected claims 1 and 3-14 under 35 U.S.C. § 103(a) as being unpatentable over Noel (U.S. 6,383,540, "Noel") in view of Saska et al. (U.S. 5,443,650, "Saska"). Applicants traverse the rejection.

The method described by Noel is related to demineralization of whey. The process is first conducted by percolation on a weak cationic resin (carboxylic resin) where 60 to 65% of the divalent cations Mg^{2+} and Ca^{2+} are exchanged for protons. Then the treatment includes either a second step on a strong cationic resin to remove the remaining divalent Mg^{2+} and Ca^{2+} cations, followed by a third step of treatment on strongly anionic resin; or it includes a treatment on a "mixed bed" column (having a mixture of 2 resins: strong cationic and strong anionic). Noel teaches that the process including the strong anionic resin exchanges mainly sulphate anions (col. 3, line 64). It is pointed out further at col. 4, lines 15 to 30, that the substance is subjected (after electrodialysis) to a further exchange on a strong anionic resin "that serves this time to exchange citrate and phosphate ions for chlorides, *i.e.*, divalent anions which could not be retained by the preceding resins because of the presence of sulphate ions and because they are in competition with said poorly ionized anions for the resins" ... and "the phosphate and citrate divalent anions are no longer in competition with more

unstable anions so the resin can substitute them more easily."

Therefore according to Noel the process is conducted through 3 or 4 steps including: 2 steps of treatment on cationic resins and 2 different steps of treatment on strongly anionic resin (or 1 combined step of treatment on a column having a mixture of strong cationic and strong anionic resins). It is emphasized in the Noel reference that the first treatment on a weak cationic resin has the advantage of lowering the pH, but it is not efficient enough to remove all the divalent cations: only 60 to 65% are exchanged. This implies the importance of carrying out one more treatment on a strong cationic resin. It is also pointed out that the first step of treatment on an anionic resin results in the elimination of sulphate ions. The divalent anions, i.e., phosphate or citrates, which must be removed last, can be eliminated at the 4th step on the strong anionic resin or with the passage through a membrane.

As described, the Noel process involves several steps, which is very costly from an industrial scale point of view and produces a large amount of effluents. Furthermore, as it is described, the first step of treatment does not have a high efficiency. Also, exchanges on cationic resins where the counter ion is H+, as in Noel, are known to have low selectivity. Additionally, as emphasized in the formerly transmitted Declaration, dated August 2009, and signed by Stanislas Baudoin, the regeneration of the weak cationic resin is costly.

It is pointed out that the goal of the process according to Noel was based on the observation that "of all salts, it is known that phosphate ions are the most difficult to eliminate" (col.2, lines 27-29). Therefore one having the knowledge provided by Noel, would not have had the idea to first perform the treatment on anionic resins. It is

clear that the whole process of Noel is constructed on the idea that the medium is transformed in order to have the best possible phosphate elimination, which according to Noel must be performed last, after removal of the competing divalent cations Ca^{2+} and Mg^{2+}. This is not at all the purpose of the present invention, that is, to obtain less costly, but highly efficient treatment in order to realize the best possible elimination of divalent cations Mg^{2+} and Ca^{2+} with no disadvantages such as elimination of any other ion species such as is the case with the use of the H+ counter ion resins (see the specification [0016]). For the above reasons one skilled in the art would not have tried to change the order of the steps of Noel, thus one skilled in the art viewing Noel would be led away from the process of claim 1.

The process described in Saska relates to the aqueous sugar juice industry. It consists of a process for softening an aqueous sugar juice containing Mg^{2+} and Ca^{2+} cations, through the treatment on a cationic resin exchanging to Na+ or K+.

There is no (or a very low) amount of citrate or phosphate anions in such juices. Therefore the use of an anionic resin is not necessary. Furthermore, no protonation is described, because there is no reason to lower the pH such as is the case in the Noel process: there is no reason to get rid of divalent anions. As the process regards the aqueous sugar juice industry, a decomplexation of the complexes between Mg^{2+} and Ca^{2+} and divalent anions such as phosphate and citrates is not suggested as it is unnecessary.

In fact, as explained in the formerly provided Declaration of Stanislas Baudoin, such treatment can be helpful in the sugar industry, but it is not adapted to the whey industry. The Table, page 6 of the instant specification shows a comparison

between a system where there is only a treatment on a strong cationic resin and a system according to the invention with a first treatment on a strong anionic resin before the further treatment on the strong cationic resin. The data show clearly that the decalcification ratio is much higher (92%) in the case of the system with the first treatment on the anionic resin, by comparison to a Saska-like system, with only a treatment on a strong cationic resin that gives 76% decalcification ratio which represents an improvement of 16% (corresponding to a relative improvement of more than 20%).

Generally speaking the processes for softening aqueous sugar juices have been available and used since long ago (more than 40 years ago). They have no relationship with processes for demineralization / decalcification of whey. So there was no reason when searching for a process relating to decalcification of whey to look for techniques adapted for softening aqueous sugar juices.

In view of the foregoing, there is no reason or motivation to combine the Noel and Saska references to achieve amended claim 1. The problem to be solved in Noel, *i.e.*, the elimination of divalent anions in whey, is far different than that of Saska. As mentioned above, the aim of the Saska process is with regard to the aqueous sugar juice industry, and is not at all related to the elimination of divalent anions such as phosphate and citrates. Thus there would not have been reasons for the combination of Saska with Noel. Additionally, the skilled artisan interested in the Noel process would not have been interested by or led to look to Saska, because the Saska method does not provide the low pH of the H+ counter-ion of the Noel resin, which is important for further treatments for elimination of anions. Also, based on the teaching of

U.S. 2,708,632, commented upon hereinbelow, one skilled in the art would not have eliminated the mixed-bed resin system.

Even if a combination of Noel and Saska could be made, which is not conceded by the applicants, a combination of the teachings of Noel and Saska would lead to the use of a cationic resin exchanging to Na+ or K+ instead of the weak cationic resin (carboxylic resin) of Noel. However, at no moment would the combination lead to the decomplexation of complexes between divalent cations and divalent anions such as phosphate and citrates. Thus there would be non-exchanged ions remaining on the resins because the complexes are not decomplexed either by the low pH, or by a previous treatment, such as is described in the present invention. It is emphasized that in the second step of the Noel process, the first exchange on a strong anionic resin, has the goal of removing anions such as sulphate ions that are said to be a concern in further treatments in order that it be possible to eliminate the other divalent ions in competition with more unstable anions.

The Noel reference clearly states the problems to be solved include the difficulty to transfer divalent ions (cations or anions) from whey, the great expense to extract calcium and magnesium ions, and mostly that it is very difficult and expensive to remove phosphate and citrate ions. The solution to these problems was the specific several-step (3 or 4 steps) method developed by Noel. Add to this the fact that that one skilled in the art would be motivated to obtain a less expensive method and/or one more convenient for industrialization, an artisan combining the teachings/methods disclosed in Noel and Saska, the skilled artisan would have tried to introduce the use of a cationic resin exchanging Na+ or K+.

Specifically, 1) even if one skilled in the art would have used a mixture of two resins such as in Noel, *i.e.*, a strong cationic resin and a strong anionic resin, said to be a "mixed bed", according to the assertions of Noel: "[I]n this column, exchange occurs between any remaining calcium and magnesium divalent cations ...between sodium and potassium ions ... and finally between mainly sulphate anions and chloride anions." (column col. 3, lines 61 to 65). Accordingly:

-even with a mixture of resins, one would expect the anion exchange to take place after the cation exchange, and

-one would expect that sulphate ions would be exchanged, not the other divalent anions at this step (or at least very few of them).

Additionally, Noel says that the substance contains a large quantity of protons, but in case the resin is not a resin exchanging protons, but exchanging sodium or potassium ions, there is no lowering of the pH in the same way. Therefore the decomplexation of complexes made of divalent cations Mg^{2+} and Ca^{2+} and divalent anions (such as phosphate, citrates ...), can not occur in the same manner.

2) Combining the two references would have led to the introduction of two additional steps, one for electrodialysis and one more anion exchange on a strong anionic resin, according to what is stated in Noel at col. 4, lines 17 - 20 in order to exchange citrate and phosphate ions. Nowhere is it suggested that the additional steps could be avoided; nowhere is the result of the instant invention expected.

In the Office Action at page 5, paragraph 16, the examiner stated the results presented in the Baudoin Declaration are "insufficient to overcome the rejection as they are not sufficient to permit a conclusion regarding unexpected results".

Applicants disagree and point out that the Baudoin Declaration provides the evidence of unexpected results wherein the presently claimed method is highly performant: particularly in paragraph 15, the comparison of tests 2 and 3 shows that adding the use of a strong anionic resin before the use of a strong cationic resin improves the softening from 72.8 to 95% (22% increase). Nowhere in the cited references, alone or in combination, is there a suggestion such a result could have been expected. It is the same for tests 1 and 4 where the result is improved from 73.6% to 97.7% (24% increase). The applicants submit the foregoing is very clear evidence of unexpected results, and shifts the burden to the examiner to provide a clearly-stated rationale why such evidence is not adequate. Applicants further submit that if the examiner believes further comparative data is required that the specifics of such further comparative data should be described.

U.S. Patent 2,708,632

This patent relates to deionization of milk and teaches that the passage through an anionic exchange column raises the pH. For this reason it is recommended to use a mixed bed system. Therefore, this means that one who would have tried to use prior art in order to improve this type of treatment would not have limited his overview to only the two cited references but would have examined all of them. So the skilled artisan would have included the mixed-bed system in the process, which is not the case in the claimed invention.

Conclusion

The Noel reference, alone or combined with Saska could not have led to the invention because the combination would have been different than the claimed

invention. Furthermore the Noel process does not solve the problem of the cost of the industrial process. Also, US 2,708,632 would have compelled the skilled artisan to keep in use the mixed-bed system and not to perform the anionic exchange first. Moreover, nowhere does the prior art suggest that carrying out the process of the claimed invention could lead to improved results. Applicants submit the rejection is overcome and requests it be withdrawn.

In view of the foregoing, Applicants submit that the instant claims are in condition for allowance. The Examiner is urged to contact applicant's attorney at the number below to expedite the prosecution of this application.

Respectfully submitted,

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